

EXECUTIVE SUMMARY

I. Background and Purpose of the Report

This report was completed under a grant from the Environmental Protection Agency (EPA) to the City of Aberdeen (the City) as a Brownfields pilot project under EPA's Brownfields Economic Improvement Initiative. Brownfields are potentially contaminated sites that can offer economic improvement through enhanced use. Brownfields are often abandoned, idled or under-used because expansion or redevelopment is complicated by real or perceived contamination. EPA's Brownfields Economic Improvement Initiative was established to empower states, communities and other stakeholders to work together to reuse Brownfields sites.

The Brownfields Pilot Area, the topic of the City's grant, is a mixture of residential, light industrial and undeveloped lands located east of the city center. A goal for the City's grant is to conduct studies that will pave the way for the cleanup of contaminated areas within the Pilot Area in a cost-effective and timely manner. In addition, with the benefit of the input and insights of those living in Junction City and vicinity, the City will facilitate development of an economic improvement plan for the entire Brownfields Pilot Area. Various options for economic improvement will be considered, including those that maintain existing uses and augment existing uses through the infusion of new business and possibly tourism. The plan developed will be consistent with protection of important natural resources found in the Pilot Area.

The Department of Ecology (Ecology) has placed *some, but not all*, of the land within the Brownfields Pilot Area on the state's Hazardous Sites List under the Model Toxics Control Act (MTCA); the land placed on the state's list is identified as the Roderick Timber Company site. The Hazardous Sites List includes sites that are identified for potential remedial action by Ecology. The sites on the list are ranked to provide a sense of relative priority for cleanup. The state-listed Roderick Timber Company site spans land on both sides of Hagara Street. On the west side of Hagara Street, land within the state-listed site is owned by the Quigg Brothers. On the east side of Hagara Street, land within the state-listed site is owned by the Grays Harbor Historical Seaport Authority (GHHSA). Consistent with the goals of the Brownfields pilot project grant, the City is taking steps to pave the way for appropriate actions leading to the retirement of the Roderick Timber Company site from Ecology's Hazardous Sites List. Delisting of the Roderick Timber Company site will build towards economic improvement. One of the activities that the City has undertaken to achieve these objectives is the remedial investigation (RI) and feasibility study (FS) described in this report (RI/FS). A RI analyzes the nature and extent of contamination at a site. A FS presents an analysis of whether or not a remedial action is warranted and, if so, the FS helps identify remedial alternatives that are appropriate to protect health and the environment and are cost-effective.

This RI/FS focuses on one part of the Pilot Area, the eastern portion of the state-listed Roderick Timber Company hazardous waste site (the Investigation Area). The western portion of the state-listed Roderick Timber Company site, owned by the Quigg Brothers, currently is being studied by the owner's consultants and reviewed by Ecology. As a result, the western portion of the state-listed Roderick Timber Company site is discussed only briefly in this RI/FS. However, the Quigg Brothers' process and this RI/FS together address the entire Roderick Timber

Company site. The Quigg Brothers' process, reviewed by Ecology pursuant to MTCA, is integral to the removal of the Roderick Timber Company from the state's Hazardous Sites List.

The Investigation Area was used previously as a landfill for dredge spoils, wood waste and garbage. Portions of the landfill have been abandoned, while the northern portion was used as a maintenance facility and currently as a youth education center. The Investigation Area (as well as the remainder of the state-listed Roderick Timber Company site) is of concern to the community because of the presence of potentially contaminated soil, groundwater and sediments. The boundaries of the Investigation Area include Hagara Street and Junction City as its western and northern boundaries, respectively. The Investigation Area is currently owned by GHSA.

Purpose. The purpose of this RI/FS is to present the data collected at the Investigation Area and to characterize the potential environmental contamination. The environmental data is then used to develop and evaluate cleanup alternatives. Once alternatives are presented, an overall cleanup strategy can be selected consistent with the Brownfields Pilot Project's economic improvement goals.

In addition, consistent with MTCA requirements to consider community input and concerns, this document outlines studies undertaken and analyses performed that help address concerns raised during the various community outreach activities that have occurred throughout this project. This information is incorporated into the various sections of the document as well as presented wholly in a separate section – Community Outreach Activities, Community Input and Concerns and Responses to Community Concerns.

2. Investigation Area History

The Pilot Area and Investigation Area are in a floodplain surrounded by the Chehalis River to the west and south and a slough to the north and east. Historical information reviewed suggests that the Investigation Area used to be entirely wetlands (around seven-foot elevation) that experienced wet season flooding. Among the first industries to begin operating in the Pilot Area were sawmills located along the Chehalis River.

A 1938 aerial photograph indicated the Investigation Area was not developed, although the area had likely been logged. The Investigation Area was used as a landfill for wood waste, dredge spoils and garbage over many years. According to a letter from M. Snell to the Port of Grays Harbor dated August 13, 1974, "The area [including the Investigation Area] has been used for dredging spoils and mill yard waste for the past fifty years to my knowledge."

Known disposal events include placement of dredge spoils by the U.S. Army Corps of Engineers (Corps) from dredging along the Chehalis River before 1956 and 1958 (GeoEngineers, 1987). These spoils were placed over the western portion of the Snell Tract, the Investigation Area. The City soon after (assumed to be 1958 or 1959) obtained sand from the dredge spoils for use as fill in a sanitary sewer line construction project (GeoEngineers, 1987). A later photograph (1966) indicated the filling of the Investigation Area, as the area was clear and generally flat except for depressions filled with water in the southern portion of the area. Several sources indicated that the Snells operated a solid waste (garbage) landfill at the

Investigation Area between 1958 and 1968. The location of the garbage landfill appears to have been along the eastern portion of the Investigation Area. The western portion of the Investigation Area was used for log storage.

In the mid-1970s, Phillip E. Roderick purchased property in the Pilot Area that included both the eastern and western half of the state-listed Roderick Timber Company site and transferred the properties to the Roderick Timber Company in March 1977. The timber company operated its main yard west of the Investigation Area (Quigg Property). Roderick's use of the Investigation Area included using the northern portion of the Investigation Area as a truck maintenance facility and a log-processing yard. Roderick planned to use the southern portion of the Investigation Area for dredge spoils as they constructed a boat basin and wharf along the Quigg Property.

Roderick later used the dredge disposal site for disposal of wood waste (bark, knots and chainsaw kerf as well as soil and crushed rock from the surface of the log yard) from the main timber yard operations across Hagara Street. Roderick developed the northern portion of the landfill site as a truck maintenance yard. Operations in the maintenance yard included fueling from underground storage tanks (USTs), vehicle maintenance and truck and equipment steam cleaning.

Ten years after Roderick Timber Company went bankrupt and ceased operations, in 1998 GHHSa purchased the Investigation Area and the wetlands to the east. GHHSa wanted to use the fenced former maintenance yard for its youth shipbuilding and woodworking programs. In January 1999, GHHSa brought utilities to the site. A two-foot-wide, three-foot-deep utility trench was excavated from Hagara Street along the north boundary of the property to the main building. Between January and March, at Ecology's direction, GHHSa brought clean fill (soil and gravel) from offsite to cap (cover) the existing soil. The cap was approximately four inches thick.

Other construction activities took place and utility trenches were excavated in the fenced maintenance yard. In general, excavations were backfilled with the excavated materials and clean fill was supplied to cover the disturbed areas. In September 1999, an engineered septic system was installed in the fenced area. In August 2001, limited excavations occurred between the main building and the septic tank (north side of the building) because the old sewer pipes were cracked and required replacement.

In June 2000, trenches were excavated around the west side of the main building to bring water lines to the south side of the building. In February 2001, the old wood-frame building outside of the fenced area (the building at the northwest corner of the Investigation Area) was demolished, leaving a concrete footprint. Clean fill was brought in to cap this area. It is not known if the well associated with this building was abandoned properly. In March 2001, GHHSa installed a Tall Masts Ropes Course in the southeast corner of the fenced area and holes were dug to install the posts. Following backfilling with excavated material, the ropes course area was covered with wood chips to a depth of one to two feet.

During these various activities there were community concerns that GHSA might be disturbing soils that were contaminated and moving them from one place to another. Moreover, there were concerns that such earth moving and digging activities resulted in exposures to youth and others.

3. Site Investigations And Remedial Activities Pre-Dating This RI/FS

In the late 1980s, the Investigation Area, then referred to as the Roderick Timber Site, appeared on the Department of Ecology's regulatory radar screen. There was a flurry of response activity and sampling activities during 1987-1989. This was followed by a hiatus of activity. Sampling and response activities occurred again in the late 1990s. The data collected as a part of these efforts have varying utility. Some data were collected in areas that later underwent remedial action; as a result, such data pre-dating cleanup have no utility at all in predicting current conditions. Other data were collected in areas not remediated. However, some of the latter data have limited utility because they were produced using outdated sampling and analysis techniques.

In the late 1980s three remedial actions were conducted at the site in the maintenance area. In addition, two rounds of sampling were conducted. Little reliance was placed on data from this period. Such data are over ten years old, and putting aside other limitations related to sampling and analytical techniques, such data are not representative of current site conditions especially because some samples were collected in areas that later underwent remediation.

In July 1998 Ecology asked Olympus Environmental, Inc. (Olympus) to perform additional site work at the Investigation Area. Olympus disposed of the investigation-derived waste (IDW) from the two 1988 studies (58 drums). Olympus also collected soil and water samples. In September 1998, they excavated soils north of the pumphouse in the vicinity of the USTs suspected to have diesel-contamination. Olympus backfilled the excavated area with rock and disposed of the soil at a facility off site. Olympus collected additional samples at the site in 1999, including surface water, sediment and groundwater samples. In September 1999, Ecology collected two soil samples from the septic tank excavation north of the main building. Since 1998, including during the period of use of the site by GHSA, there have been no remedial activities at the site.

4. Site Investigations Undertaken as a Part of This RI/FS

In order to gain a clear understanding of current site conditions in the Investigation Area and to address community concerns specifically, substantial additional sampling was undertaken. Such sampling was undertaken in 2001 through 2002. A total of four rounds of sampling was conducted to, among other things:

- ◆ Create a better understanding of the hydrogeology and site lithology;
- ◆ Create a *current* picture of the nature and extent of contamination in the fenced maintenance yard and in the landfill;
- ◆ Assess the risk, if any, associated with contamination found;
- ◆ Address community concerns about whether or not a plume of contamination was migrating into Junction City;

- ◆ Evaluate whether or not there was contaminant migration from groundwater to surface water;
- ◆ Delineate areas of waste (garbage and woodwaste) in the landfill;
- ◆ Delineate further the contamination in the swale north of the Investigation Area;
- ◆ Address community concerns about orange material found in ditches,
- ◆ Investigate an area at a location known as GP-4;
- ◆ Investigate a community concern that a significant quantity of oil had been dumped at the site;
- ◆ Sample for hexavalent chromium to address EPA and community concerns; and
- ◆ Address community concerns about the impact, if any, of GHSA excavation and earth moving activities in the fenced area.

5. Geologic And Hydrogeologic Site Conditions

Hydrologic data collected during the 2001 and 2002 rounds were reviewed to provide a more complete understanding of hydrological conditions of the Investigation Area. In addition, analysis benefited from data collected during earlier time frames. An analysis of the data indicated that two primary stratigraphic layers exist at the site, referred to as the Lower and Fill Horizons. The Fill Horizon, as its name implies, was formed as a result of placement of fill. Water level data suggest that the Fill and the Lower Horizons generally behave as one heterogeneous unconfined aquifer, and that there is a generally consistent radial groundwater flow pattern beneath the Investigation Area, primarily toward the Chehalis River. Data also suggest the Lower Horizon likely represents a significant barrier to the downward migration of potential contaminants through the Lower Horizon into the deeper subsurface. Although tides influence surface waters of the area, no significant tidal influence was measured in site wells.

The water level maps show a generally consistent radial groundwater flow pattern beneath the Investigation Area, indicating groundwater flow southwest, west, and northwest, toward the Chehalis River. At least some of the time a mounded pattern is present, suggesting radial flow in all directions, toward the Chehalis River, surrounding creeks, Junction City, the Elliot Slough, and wetlands.

The vertical flow of groundwater suggested by water level data from the paired monitoring wells and the similarity of the potentiometric surface maps indicate hydraulic communication between the Fill and Lower Horizons. The Lower Horizon therefore does not necessarily confine potential dissolved contaminants to the Fill Horizon. However, as mentioned in the section above, the lithology of the Lower Horizon, which includes a high proportion of clay and silt, is likely to represent a significant barrier to the downward migration of potential contaminants through the Lower Horizon into the deeper subsurface.

6. Analytical Results

Voluminous site data have been produced as a result of the four sampling rounds in 2001-2002 and numerous samples taken in the 1980s and 1990s. Not all data are equally useful for describing current site conditions and for addressing existing potential contamination. Analytical data have been summarized in the report according to different conceptual categories helpful to:

- ◆ Develop a conceptual site model;
- ◆ Understand the current nature and extent of contamination and its fate and transport;
- ◆ Understand the current nature, if any, of any risks to human health and the environment,
- ◆ Provide information useful to the analysis of cleanup options, and
- ◆ Inform the public regarding the results of investigations undertaken to address specific community concerns regarding potential contamination.

A review of chromatograms associated with samples taken in the first round of 2002 sampling led to the conclusion that detections of DRO and ORO at the site could be of biogenic origin (produced by living organisms or biological processes). To eliminate organics of biogenic origin as a source of detections at the site, in the last sample round in 2002 EI performed an Ecology-approved technique known as silica gel cleanup. All samples analyzed for DRO and ORO with silica gel cleanup fell below MTCA Method A criteria; in all but one sample, DRO and ORO were not detected above the detection limit. These results demonstrate that the site is highly influenced by organics of biogenic origin.

A summary of the analytical results by media is presented below and then major concerns of the community are summarized and addressed. The full report also discusses site characterization data by different types of compounds – inorganics (metals) and organics.

Results by Media

Surface water samples have been collected throughout the Investigation Area and in the wetlands to the east. Key compounds of potential concern not detected in surface water samples were gasoline-range organics (GRO), PAHs, pesticides, PCBs and resin acids. Overall, there were few detections (exceeding and non-exceeding), and they were for diesel-range organics (DRO), oil-range organics (ORO), six VOCs, bis(2-ethylhexyl)phthalate, and 13 metals. The recent silica gel cleanup results demonstrate that the exceedance of the MTCA ORO criterion is likely to be caused by organics of biogenic origin rather than petroleum products.

Overall, 34 **sediment** samples were collected in many of the swales where surface water samples were collected. Key compounds of potential concern not detected in sediment samples were GRO, pesticides and PCBs. DRO, three VOCs, naphthalenes and other SVOCs were detected at low concentrations, generally slightly greater than the laboratory detection limit and well below MTCA criteria. Six samples from recent sampling had compounds exceeding the MTCA criteria for residential soil, two of which were for ORO. The concentrations of ORO are only slightly greater than the MTCA criterion and may reflect organics of a biogenic origin rather than petroleum contamination exceeding the MTCA criterion. One 1988 sample showed a detection of cPAHs at 0.73 mg/kg in sample S-3 from the Stanley Street ditch.

Many **surface soil** samples were taken in or adjacent to the fenced maintenance yard and north of the Investigation Area in Junction City. Samples were analyzed primarily for petroleum hydrocarbons and VOCs. Some samples were analyzed for PAHs, SVOCs, PCBs and metals. GRO was not detected in surface soil samples. DRO, six VOCs, naphthalenes, seven other SVOCs and metals were detected at low concentrations, generally slightly greater than the

laboratory detection limit. Compounds exceeding MTCA Method A criteria were primarily ORO and cPAHs at six locations in the fenced Maintenance Area and one at the corner of Hagara and McNeal Streets. The ORO exceedances may well be caused by organics of biogenic origin rather than petroleum products. A 1988 sample had a cPAH concentration of 0.1 mg/kg and vinyl chloride of 0.19 mg/kg. With the lapse of time, vinyl chloride, a highly biodegradable compound under aerobic conditions, would be naturally transformed to non-toxic compounds. The cPAH compounds would also be degraded to a concentration that is lower than the MTCA Method A criterion.

Most of the **deep soil** samples were collected from soil borings drilled and test pits excavated in the maintenance area. Samples were analyzed primarily for petroleum hydrocarbons and VOCs. A few samples were analyzed for PAHs, SVOCs, metals and conventional parameters. Compounds exceeding MTCA Method A criteria were primarily petroleum hydrocarbons and cPAHs at locations in the northern portion of the Investigation Area and two in the Dredge Disposal Area. Exceedances of DRO and ORO may be of biogenic origin rather than petroleum products. One sample has a GRO concentration of 84 mg/kg that is considered not to be an exceedance because benzene has not been detected in the area. Samples collected in the UST area excavated by Olympus in 1998 had DRO exceedances, but this contamination has been the focus of a remedial action. Low concentrations of several other compounds were detected; most were near the laboratory detection limit. Compounds included VOCs, naphthalenes, other SVOCs and metals.

Thirty-seven monitoring wells were installed in and near the Investigation Area. During 2001 and 2002, four rounds of **groundwater** sampling were conducted. Most, but not all, wells were sampled in each 2001 round. All wells with water, of which there were 34, were sampled during both 2002 rounds. Samples collected in 2002 for metals analyses were filtered to obtain dissolved concentrations, which measure the concentrations in groundwater and are indicative of the concentrations that could migrate. Data show that there are slight exceedances of arsenic in the Lower Horizon. None of these arsenic concentrations is greater than the marine chronic surface water standard. Manganese was detected in some wells in excess of the MTCA criterion; however, there is no pattern that would indicate a source or plume. In addition, manganese was detected in wells considered not to be influenced by the site. Moreover, manganese is an element found in seawater. It is not surprising that it appears in higher concentrations in a wetlands area that is located near the ocean and within the marine environment. Several groundwater samples underwent silica gel cleanup to remove biogenic interferences. Petroleum hydrocarbon results with the cleanup procedure indicated that the concentration measured without cleanup resulted from measuring other types of organics (not petroleum hydrocarbons). In all but one sample, the concentrations dropped below the detection limit after silica gel cleanup. Because the concentrations without silica gel cleanup were similar to those of past sampling rounds, it appears that exceeding concentrations from earlier rounds are due to biogenic interferences. As a result, no exceedances were found for DRO and ORO in groundwater.

Key Community Concerns

The following discussion describes the analytical results according to key concerns raised by the community – whether or not 1) hazardous substances are migrating from the filled area off site

and the nature of the orange material observed in ditches near the site, 2) there is current contamination of concern in the area of the prior sample location GP-4 across Hagara Street from the Site Investigation Area, 3) oil that had been dumped in the landfill is a cause for concern, and 4) Junction City has contamination of concern.

Members of the community expressed concerns to the Department of Ecology that the landfill might be causing contamination in the groundwater underlying Junction City. Concerns were expressed that orange material observed in ditches might be indicative of hazardous “leachate.” Other members of the public expressed fears (to the City and Ecology) that there might be a plume of contamination from the site migrating under Junction City. Although Junction City is on city water and there are no drinking water wells in Junction City, this concern has persisted.

In brief, the data collected during the 2001 - 2002 sampling rounds are not supportive of the theory that a “plume” of contamination is migrating off site. On-site wells along the border of Junction City have consistently returned results below MTCA Method A criteria for organics and metals, the contaminants of concern at the site. Moreover, the conventional parameter data do not support the conclusion that hazardous substances are leaching from the landfill area into ditches. Analytical results show that the orange material is consistent with formation of iron oxide that precipitates out of solution when ferrous iron encounters oxygen. Iron oxide is not a hazardous substance and is not a risk to health.

A commenter on an early draft of this RI/FS expressed concerns regarding a sample taken in 1999 with a push-probe at a location identified as GP-4, across Hagara Street from the Investigation Area. The commenter was concerned about analytical results indicating high concentrations of metals. As a result, the Department of Ecology directed that samples be taken in the area of the former GP-4 sample. Of the five samples analyzed for metals, only one sample had a dissolved arsenic concentration slightly above the MTCA Method A criterion of 5 ug/L. This sample (GP-4W) was from the Lower Horizon and had a dissolved arsenic concentration of 9.2 ppb. No detections above MTCA criteria occurred for any of the other metals in this sample and other samples. Based on the newly collected information, previous GP-4 sample results are likely to be biased high, probably from the presence of silt in the groundwater that was not filtered before sampling. Of the organic results, two samples initially showed DRO detections above the MTCA Method A criterion. When these were re-analyzed using Ecology’s prescribed silica gel cleanup for removing biogenic interferences, DRO was no longer detected above the detection limit. Accordingly, GP-4 is not considered an area of major concern.

Community members expressed concerns that a significant quantity of oil had been dumped in the landfill. As a result, efforts were undertaken during the RI to determine whether or not significant contamination remained from this dumping event and whether or not the disposal was a continuing source of releases of concern to the community and the environment. It is important to note that this dumping event occurred decades ago and may have undergone natural bioremediation and attenuation. EI personnel walked areas of the site in which community members believed that the oil might have been dumped. No evidence of a spill was readily apparent with visual observations. Approximately 50 test pits were excavated in the Investigation Area and no oil affected materials were observed. In addition, 2002 groundwater samples collected from the monitoring well in the area did not show petroleum hydrocarbon or

metals exceedances. Fuel and oil do not appear to have been disposed in this area and organic detections in the samples may be a result of biogenic sources such as woodwaste.

A commenter expressed concerns about historic data that had been collected in Junction City using push probes. To understand whether or not these early samples collected by a less reliable and inaccurate method of groundwater sampling were truly representative of conditions in the community, the Department of Ecology directed that a monitoring well be installed in Junction City. Prior to sampling, according to good sampling practices, the well was developed, purged and sampled. Samples also were taken in 2001-2002 of surface water, sediment in a ditch with orange material, and soil.

Groundwater along Stanley Street appears affected by petroleum hydrocarbons, albeit recent samples subject to silica gel cleanup demonstrate that levels are below MTCA criteria and are not of concern. In addition, a local resident recalled disposal of diesel and solvents at or near the monitoring well. The analytical data, coupled with the historic information, suggest that the spill in the neighborhood may be the source of the concentrations seen. Manganese was detected just slightly above the MTCA Method B criterion of 2,240 ug/L. As manganese was not detected in the wells in the northern portion of the Investigation Area, it does not appear to be migrating from the site and is likely to be associated with the brackish wetlands that underlie.

The swale north of the maintenance yard was tested in three rounds. Two of twelve samples have shown exceedances of cPAH and three have indicated slight exceedances of ORO in sediment but were not subject to silica gel cleanup. If these samples were subjected to this technique eliminating biogenic interferences these samples are not likely to have shown exceedances. The cPAH exceedances were in the swale soil and sediments and may be from truck and equipment wash water runoff. This swale is targeted for cleanup. One other sample in Junction City shows an exceedance for cPAH, a surface soil sample from the junction of McNeal and Hagara Streets. The cPAH in this sample is likely to be from vehicular traffic along the roads rather than from the Investigation Area as a cPAH migration pathway from the landfill was not identified.

7. Conceptual Site Model

A conceptual site model that is a concise summary of the preceeding information was developed to help consider whether natural processes are attenuating contamination or whether human intervention is required to remediate the contamination or create institutional controls for the site.

The site can be divided into three general areas: 1) the landfill area, 2) the truck maintenance area, and 3) undeveloped land. Assessment of whether historical activities pose a threat to human health and the environment is based mainly on chemistry of groundwater samples collected from wells.

The contamination in the Investigation Area is localized in the two areas of the site affected by historical activities – 1) the landfill and 2) the truck maintenance yard. The environmental impacts in the area of landfilling appear to be elevated concentrations of some metals in groundwater. However, the landfill is not likely to be the source of these metals for a number of reasons, including the fact that the Investigation Area was originally brackish wetlands which

have served for millennia as a natural filtering mechanism for water draining the Chehalis River Basin; filling of the area with dredge spoils; and metals results that are sporadic and discontinuous, inconsistent with a migrating plume of contamination.

Impacts from the truck maintenance yard primarily appear to be elevated concentrations of total petroleum hydrocarbons (TPH) in soil. Contaminants generally migrate in the direction of groundwater flow; however, site groundwater flow velocity is very low due to the predominance of wetland and native fine-grained sediments of very low permeability.

The site conceptual model can be summarized as two lithologic regimes, the predominant Lower Horizon, and overlying Fill Horizon, and two areas of focus for contaminant assessment, the landfill and maintenance areas. Because elevated groundwater chemistry concentrations are generally sporadic across the site and exhibit no consistent pattern near either of these areas, no contaminant plume is apparent.

8. Establishing Site Cleanup Standards

Because few contaminants exist at the site, the simplified MTCA Method A criteria are selected as the Investigation Area cleanup levels. MTCA Method A criteria are at concentrations at least as stringent as those specified in other applicable state and federal regulations and are protective of human health and the environment. Selecting Method A criteria as cleanup levels for an industrial property is a conservative approach, and appropriate due to its proximity to residences. However, because of the Investigation Area's proximity to residences and to wetlands, the points of compliance would be GHSA's property boundary for the north and west, and the landfill boundary for the northeast, east and south.

9. Cleanup Action Alternatives

To determine cleanup action alternatives, remedial technologies/approaches were identified that could address metals (arsenic, chromium and lead) in groundwater, and petroleum hydrocarbons (and cPAHs) in soil and water. These technologies/approaches were identified because they could reduce the risks to human health and the environment further and reduce the timeframe for site restoration. Because of the two parts of the Investigation Area, several remedial technologies and approaches will be necessary as components of the cleanup action.

Eight appropriate treatment technologies and approaches were developed into seven alternatives for the Landfill Area (Dredge Disposal and Garbage Fill) and twelve alternatives for the Maintenance Area. The alternatives also include provisions for monitoring and institutional controls, as necessary. The alternatives were ranked based on protectiveness of human health and the environment, permanence, cost, long-term effectiveness, short-term risks, technical and administrative implementability, and consideration of public concern. A preferred cleanup action alternative was selected for each of the areas of the site affected by historical activities – the landfill area and the maintenance area.

The preferred alternative for the Landfill Area has these elements:

- ◆ Capping of exposed garbage with soil and vegetation,
- ◆ Installing vegetation around the perimeter of the Landfill Area that can sequester or uptake metals,
- ◆ Groundwater monitoring to verify the effectiveness of the cleanup action, and
- ◆ Deed restrictions to ensure that the cleanup elements are maintained.

This preferred alternative minimally disturbs the area while providing a habitat buffer for the wetlands and protection of human health and the environment.

The preferred alternative for the Maintenance Area has the following elements:

- ◆ UST closure by excavation,
- ◆ Excavation of swale surface sediment and soils,
- ◆ Enhanced bioremediation targeting two areas (soils and groundwater surrounding the UST and soils and groundwater near the former truck parking and washing area),
- ◆ Capping the fenced area with gravel cover,
- ◆ Installation of a groundwater barrier wall,
- ◆ Installation of a bioswale, and
- ◆ Groundwater monitoring to verify the effectiveness of the cleanup action.

Selection of this alternative minimally disturbs the area and allows for continued use of the site for current purposes. This cleanup action provides several types of barriers to protect human health and the environment.

10. Community Outreach Activities

There have been various ways for the community to provide input and voice their concerns throughout the project including community meetings and public comments on draft reports. Community concerns have been considered throughout the project and have helped direct the continuing investigations at the site as well as the cleanup action alternative recommendations. Two previous drafts of this RI/FS have been completed that have been available for public review; in addition, the information found in the drafts was discussed with the community in public meetings held in July 2000, September 2000, December 2000, and January 2002. Community input and concerns have been considered as part of the site investigation and cleanup action alternative selection processes. Section 10 summarizes written comments and the City's response to them.